Ann Ig. 2023 Nov-Dec; 35(6): 670-682 doi: 10.7416/ai.2023.2572

Drug utilization and medical expenses in psoriasis treatment at a dermatology hospital in Vietnam, 2019-2021

N.P. Hung[1], V.T.M. Huong[2], D.T.V. Kieu[3], L.T. Quan[4], N.T.T. Minh[5], N.P. Thuy[6]

Key words: Health expense, medication utilization, psoriasis, use of medicines, Vietnam
Parole chiave: Spesa sanitaria, utilizzazione medica, psoriasi, uso dei farmaci, Vietnam

Abstract

Introduction. *Psoriasis is a persistent, chronic, inflammatory cutaneous disorder that recurs frequently and has negative impacts on the living quality of sufferers.*
Methods. *Data from the Inpatient and Outpatient Department medical records at Can Tho dermatology hospital were used to generate a descriptive statistics report on medicines and medical costs for psoriasis therapy in 2019-2021.*
Results. *The average number of prescription medications varied annually, averaging roughly 0.62±85.4% per prescription. Corticosteroids and calcipotriol were the most commonly recommended drugs for psoriasis. Antihistamines were the most often used medication, with over 12,000 instances among the 28,397 individuals studied. The peak in average per-treatment expenses occurred in 2021 when they fluctuated between US $120 and US $160. In contrast, examination expenses were the most costly, ranging from US $93-$107.*
Conclusion. *The bulk of psoriasis therapy treatments were topical agents, whose quantities rose progressively. Direct examination expenses accounted for the greatest proportion.*

[1] *Department of Pharmaceutical Management, Faculty of Pharmacy, Can Tho University of Medicine and Pharmacy, Can Tho, Vietnam*
[2] *Department of Medicinal Chemistry, Faculty of Pharmacy, Can Tho University of Medicine and Pharmacy, Can Tho, Vietnam*
[3] *Faculty of Pharmacy, Can Tho City Dermatology Hospital, Can Tho Vietnam*
[4] *RM Healthcare limited liability company, Ho Chi Minh, Vietnam*
[5] *Faculty of Basic Sciences, Can Tho University of Medicine and Pharmacy, Can Tho, Vietnam*
[6] *Faculty of Pharmacy, Can Tho University of Medicine and Pharmacy, Can Tho, Vietnam*

Annali di Igiene : Medicina Preventiva e di Comunità (Ann Ig)
ISSN 1120-9135 https://www.annali-igiene.it

Introduction

Psoriasis is a chronic inflammatory cutaneous disease that affects approximately 2-3% of the global population. The disease is characterized by red, scaly, and itchy patches on the skin, and is often associated with significant physical and psychological distress (1, 2). Although psoriasis has been extensively studied in Western countries, there is a growing interest in understanding the prevalence, clinical features, and genetic background of the disease in Asia. According to the World Health Organization (WHO), it is a chronic relapsing skin disorder that currently accounts for 0.09% to 11.4% population in 20 countries and involves several comorbidities such as psoriatic arthritis, cardiovascular diseases, diabetes, and steatosis (3). Psoriasis treatments do not only aim to control the symptoms and restrict their recurrence, but also improve people's life quality. Options for psoriasis treatment medications are dependent on a variety of factors including types of diseases, severity levels, effectiveness, undesirable effects of the regimen, the collaboration between doctors and patients, and economic factors (4). Psoriasis treatment regimens are extremely diverse: monotherapy, combination regimens, cyclic therapies, or level reduction therapies. As a consequence, the treatment costs of psoriasis are higher than other diseases having patients disclaim the treatment (3, 5-9). For these reasons, our study was done between 2019 and 2021 by collecting data on practice and certain parameters related to medication use and psoriasis treatment expenses at Can Tho dermatology hospital (CTDH), Vietnam.

Methods

Study subjects

The authors conducted a retrospective cross-sectional record review. All examinations of both outpatients and inpatients diagnosed with psoriasis between January 1st, 2019, and December 31st, 2021 were retrieved from the electronic health commodities information system and manual records from CTDH. Data synthesized and analyzed were utilized for that purposes only. Some sensitive data were anonymously encoded to ensure privacy.

Inclusion criteria: The patient who were diagnosed with psoriasis and received psoriasis treatments from January 1st, 2019 to December 31st, 2021 at CTDH.

*Exclusion criteria: T*he patients who did not adhere to treatment, take other medication without a prescription, or abandon the re-examination during the follow-up period.

Study site: The Inpatient and Outpatient Department - Can Tho dermatology hospital.

Data collection: Medical records with the principle diagnosis coding ICD-10: L40 for psoriasis were selected and such information as patient's personal information, admission – discharge date, medication information, treatment therapy, payment method and treatment outcomes were thoroughly recorded.

Data processing

The statistical descriptive method was carried out by Microsoft Office Excel 2013 together with EPI info 6.1 software. There is a statistically significant difference with a 95% confidence interval (CI) when $p < 0.05$. T-tests for categorical variables and ANOVA for 2 or more numerical variables were applied to check whether they are significantly correlated.

Figures on pharmaceutical payments were extracted in the local currency, the Vietnamese Dong (VND), and then converted to US $ at the rate of 1 US $ = 23,145 VND (recorded on December 31st, 2021).

Ethical approval and informed consent

The study protocol was approved by the Medical Ethics Council of Can Tho

University of Medicine and Pharmacy, Can Tho city, Vietnam (approval number 302/HDDD-PCT).

Results

It can be seen in Table 1 that out-patient medicine spending in the first year are over 26,000 US $, which is over fifteen times higher than that of in-patient medications. Despite a marginal fall in 2020 (1,632.9 US $) the figures for in-patient expenditure increased tenfold 1 year later to 1,822.8 US $. However, the proportions of pharmaceuticals for psoriatic treatment witnessed a shrink, which occupied 51.9% in 2019 but declined considerably to under 5% in 2021. Meanwhile, the percentage of psoriasis medications always remained at more than 80% during research period and reached its peak in 20 at 96%. Plus, while medicines to treat comorbid diseases made up a noticeable part of overall expenses (15.1%-86.5%) in in-patients, that of out-patients registered very minimal values (0.6%-2.2%). However, the amount of money spent on medications to treat psoriasis, generally, rose dramatically. Also, out-patient growth speed is remarkably faster than in-patient expenses, that is expenditure for out-patient pharmaceuticals almost quadrupled from 27,428.3 in 2019 to 94,248.1 in 2021 (Figure 1). Figure 1 revealed that a vast majority (68.7%-94%) of total pharmaceutical spending consisted of psoriatic-treating medicines.

Table 1 - Comparison of total spending on inpatient and outpatient treatment for psoriasis at CTDH

Categories	The total costs (VND)		
	2019	2020	2021
	Inpatient treatment		
Psoriasis	908.8 (51.9%)	702.1 (43%)	824.3 (4.5%)
Supported treatment	456.5 (26.1%)	89.6 (5.5%)	723.0 (4%)
Psoriatic comorbidities	263.9 (15.1%)	703.0 (43%)	15,770.4 (86.5%)
Others	120.3 (6.9%)	138.2 (8.5%)	910.3 (5%)
Total	1,749.5 (100%)	1,632.9 (100%	18,228.0 (100%)
	Outpatient treatment		
Psoriasis	24,989.2 (91.1%)	68,608.6 (96%)	76,513.5 (81.2%)
Supported treatment	1,476.0 (5.4%)	1,768.7 (2.5%)	11,733.1 (12.4%)
Psoriatic comorbidities	404.7 (1.5%)	474.3 (0.6%)	3,962.7 (4.2%)
Others	558.3 (2.0%)	639.2 (0.9%)	2,038.8 (2.2%)
Total	26,428.2 (100%)	71,490.8 (100%)	94,248.1 (100%)

Table 2 - Factors statistically related to expenditures for psoriasis treatment at CTDH

Categories		2019	2020	2021	*p-value*
		[Expenditure (US $), (no. patients)]			
Coverage of health insurance	*48-60%*	227.3 (n=2,714)	219.5 (n=1,941)	209.1 (n=769)	0.000
	80%	9,469.4 (n=3,091)	15,040.8 (n=2,441)	33,749.9 (n=42,060)	
	95%	226.6 (n=143)	3,498.4 (n=166)	666.0 (n=1,603)	
	100%	6,811.3 (n=6,074)	19,109.9 (n=7,506)	34,180.3 (n=28,813)	
Patient's residence	*In Can Tho city*	79,142.2 (n=17,443)	60,160.5 (n=8,518)	42,799.4 (n=4,577)	0.000
	From other provinces/cities	83,001.5 (n=13,244)	52,887.9 (n=2,921)	72,877.6 (n=1,748)	
Treatment duration	*<10 days*	51,280.0 (n=8,618)	105,138.9 (n=10,997)	102,588.9 (n=6,043)	0.000
	11-30 days	4,467.0 (n=349)	5,388.6 (n=420)	11,072.8 (n=272)	
	31-50 days	1,909.0 (n=37)	2,290.3 (n=16)	1,463.9 (n=9)	
	>50 days	55.5 (n=2)	0	551.3 (n=1)	
Treatment outcomes	*Recovered*	46,000.5 (n=7,050)	98,330.4 (n=8,874)	97,607.1 (n=4,741)	0.000
	Reliably improved	135,324.0 (n=1,878)	14,483.9 (n=2,488)	16,356.0 (n=1,539)	
	Unchanged	410.4 (n=42)	73.2 (n=41)	15.0 (n=26)	
	Deteriorated	320.4 (n=23)	160.9 (n=20)	1,696.9 (n=14)	
Comorbidity	*No comorbidity*	27,046.0 (n=2,179)	52,445.2 (n=1,124)	57,664.8 (n=738)	0.000
	1-5 diseases	27,511.0 (n=6,584)	56,212.4 (n=9,998)	52,144.4 (n=5,500)	
	6- 10 diseases	3,109.2 (n=241)	4,379.1 (n=315)	7,170.0 (n=177)	
	Over 10 diseases	45.3 (n=2)	11.6 (n=2)	1,101.0 (n=5)	

Table 3 - Psoriasis-diagnosed patient's demographics and related information (2019-2021)

Categories	Year			Mean ± SD
	2019	2020	2021	
Genders: Male	4,287	5,861	3,206	4,451.33±31.66%
Age (years)	39.89	39.28	40.59	39.92±1.68%
Comorbidities				
Hypertension	317	401	139	285.67±51.34%
Atopic allergy	2,333	3,089	1,743	981.00±35.07%
Hepatic disorders	1,385	2,006	1,212	1,534.33±30.74%
Type 2 diabetes	1,187	1,284	661	1,044.00±36.67%
Musculoskeletal disorders	75	90	66	938.33±41.39%
Renal disorders	1,105	1,160	550	938.33±41.39%
Total patients	9,006	11,439	6,330	8,925.00±29.08%

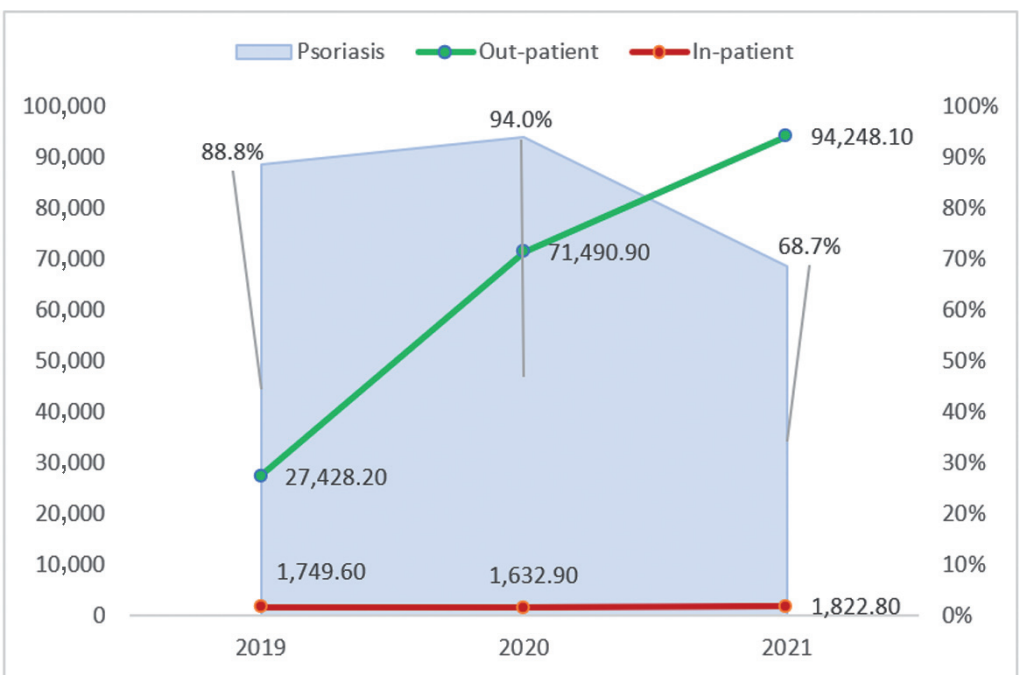

Figure 1 - Inpatient *vs.* Outpatient expenditure (US $) growth throughout years and percentages of psoriasis-treating pharmaceuticals in total spending

In the course of 3 years, the total medical direct costs reached their peak in 2019 (11,770 US $), then reduced to 8,085 in the last year (Figure 2). Generally, expenses on examination were the second greatest and were on a downward trend as well. Similar patterns were seen in the subclinical cost, which started at 740 US $ in 2019, then ended at just 336 US $. On the other hand, both medicines and surgery or procedures had a jump in overall spending although they began at very insignificant values (respective numbers for medicines and procedures were 1,728 and 0 US $) (Figure 3).

Table 2 presented 5 factors, namely, coverage of health insurance, patients' residence, length of treatment, outcomes, and concurrent diseases, found to be statistically correlated to psoriasis treatment at CTDH throughout 3 years of investigation ($p<0.01$, CI=95%). With regard to medical insurance, 80% and 100% coverage had the largest number of patients (from 28,813 to 42,060 patients in 2021) as well as monetary expenses (more than 30,000 US $ for both in 2021). The smallest amount of expenditure was registered in 48-60% of coverage (around 200 US $ per year). Plus, these figures experienced a gradual downward tendency. In 2019, a huge chunk of patients underwent psoriatic therapies in less than 10 days (8,618 out of 9,006 cases), followed by 11 to 30 days (registered in 349 cases) whereas only 2 cases had a duration of treatment of more than 50 days. Next, these quantities shrank after peaking in 2020, in a broad view. The amount of expenditure for each group of treatment length varied. While the 2 shortest durations (<10 days and 11-30 days) bottomed in 2019, the other 2 groups reached their lowest value in 2020 or 2021.

In terms of treatment outcomes, nearly 80% of patients recovered (7060 out of 9006 cases), and under 1% of them remained unchanged or deteriorated in 2019. These figures in 2020 and 2021 fluctuated unnoticeably around 75%-78%. Moreover, although there were more patients residing outside Can Tho city, CTDH allocated less money on local patients with psoriasis. The number of psoriatic patients reached its highest point in 2020 with up to 11,439 cases. Still, the largest spending was recorded in 2021 (more than 115,000 US $). Finally, an extensive quantity of patients suffered from 1 to 5 medical disorders besides psoriasis (roughly 5,410-9,998 patients per year). Some typical diseases were illustrated in Table 3.

Table 3 outlined some demographic features of patients with psoriasis in 2019-2021. There was a tiny disparity in gender where female slightly outnumbered males in the initial year (4,719 females *vs.* 4,287 males in 2019); nevertheless, figures for males surpass females in the next 2 years. The average age was ranging in the vicinity of 39-40 years old. Additionally, atopic allergy was the most common comorbidity (2,333, 3,089, and 1,743 cases between 2019 and 2021, respectively). This was followed by hepatic diseases (1,212 to 2,006 cases per year) and diabetes mellitus (661 to 1,286 cases per year). Interestingly, all concomitant disorders grew minimally in 2020 before a steep drop just 1 year later. Last but not least, the least commonly encountered condition in psoriatic patients were musculoskeletal ones, which recorded below 100 cases each year.

Antihistamine H1 became top choice of dermatologists at CTDH, which accounted for approximately 45% of prescribed medications whereas secukinumab was the most expensive active pharmacologic ingredient for psoriasis treatment (see Supplemental Materials).

Discussion

It is noticeably interesting that the percentages of men and women were roughly equal at 1:1. It was also found in another study in Iran (10), and in Malaysia (11). The average age of patients

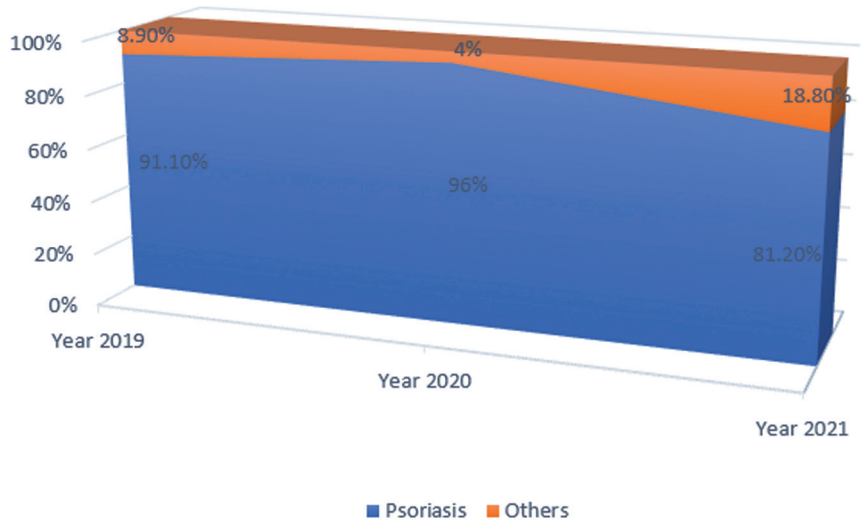

Figure 2 - Shares of medications for psoriasis-treating and for other purposes (2019-2021) at CTDH

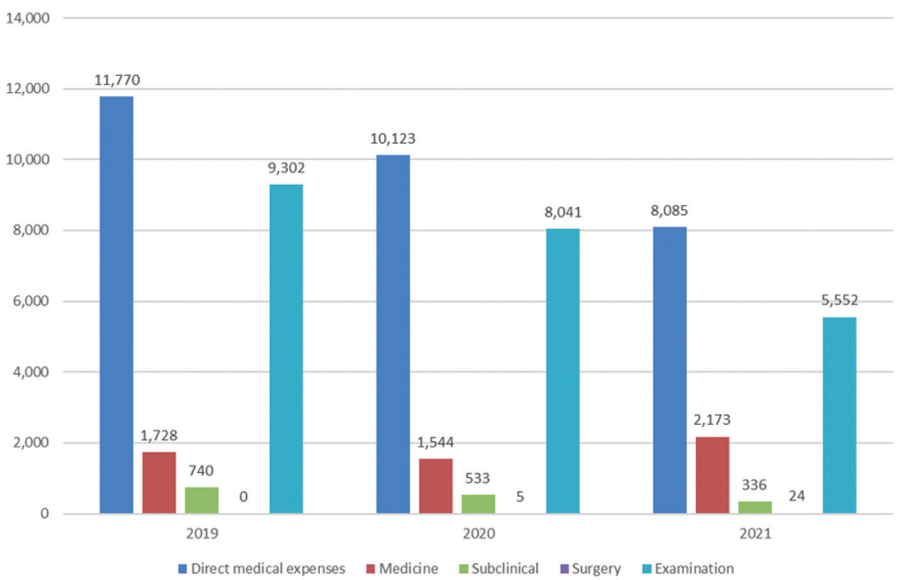

Figure 3 - Total spending on different categories (US $) to treat psoriasis (2019-2021) at CTDH

participating in the three-year research was 39.92±0.0168 years old, in which a majority of them were working- age population. It is also similar to several studies, particularly by Al Sawah et al (46 years old) (12), Antoni et al (47.10 ± 12 years old) (13), Mashor et al (31.36 ± 11.72 years old) (11), and Galimberti et al in Argentina (34 ± 12 years) (14).

Comorbidities are a concern for hospitalized patients receiving medical assessment and treatment, as the mortality rate associated with psoriasis might increase when comorbidities are not managed appropriately (15). In the hospital, patients with psoriasis also suffered from hypertension, atopic eczema, peptic ulcers, liver pathology, type II diabetes, musculoskeletal pathologies, and mild renal ailments. These results converge with the results of Benites et al in Ecuador from 2020-2021 (16). In particular, patients with moderate-to-severe psoriasis accounted for a higher prevalence of comorbidities in Feldman et al investigation (17). Besides the aforementioned comorbidities, psoriasis can associate with other health problems such as heart disease, diabetes, obesity, chronic kidney disease, liver disease, enteritis (18), myocardial infarction (19), and chronic obstructive pulmonary disease (19). There was a distinction of comorbidities based on time, place, and epidemiological factors in each study.

The average number of medicines per prescription has fluctuated unevenly over the years and on the average there were roughly 0.62 medicines per prescription after 3 years. Generally, medicines for supportive treatment and comorbid condition treatment were more commonly prescribed than others. Corticosteroids and calcipotriol were the most prescribed psoriasis treatment medications, which was comparable to the study result of Ghasri et al at 51% and 31% respectively (20). Besides, among topical corticosteroids, those with strong activity often accounted for a large proportion. In detail, according to Bhuvana et al, in India, topical corticosteroids accounted for 42% of the total number of prescribed medicinal products, mainly those with very potent (73%) and potent (14%) (21).

Among various types of systemic psoriasis treatment medications, acitretin and methotrexate were commonly used, whereas acitretin was prescribed more often than the other. Also, this research outcome is equivalent to that of Augustin et al in England in 2011 and that of Boffa et al in Europe in 2005, in which the rate of using medicines was methotrexate (61% and 44%), followed by retinoid (8% and 32%), and ciclosporine (7% and 16%) (22, 23). However, all these studies indicate that methotrexate was the most commonly prescribed medication because it was still the first-line option with its low cost but high effectiveness for psoriasis treatment (21), which was proved by Benites et al (16). As a result, the use of systemic medications as psoriasis treatment has increasingly kept pace with countries around the world.

Regarding the remaining medicines, the supportive ones and others accounted for a greater number compared to comorbidity treatment medicines. As a result, a psoriasis-supported treatment medicine, antihistamine H1, was used at the highest rate with over 12,000 people out of 28,397 respondents.

The average cost per treatment has ranged from 121 to 160 US $, whereas the cost of buying medicines per turn fluctuates from 2.4 to 33 US $. However, the cost per treatment among 5 European countries (Germany, Spain, France, Italy, and the UK) in 2015 (24) was around US $ 2,077-13,132. Another study indicated the total annual cost of each patient was €11,928 in Sweden, €8,372 in Italy, € 2,866 in Germany, and US $ 7,999 in Canada (18) and Carrascosa et al also demonstrated that the total average cost for psoriasis treatment was €1,079/patient/year

in Spain (25). This spread can be explained by the alteration in price and treatment quality among the countries that changed to expensive probiotics which led to an increase in drug costs in the total treatment costs (26).

Due to many related factors such as health insurance, patient's residence, duration of courses, and the number of comorbidities, etc., there was a gradual increase in the costs for psoriasis treatment from 2019 to 2021 which directly affected patients' treatment results.

Comorbidity became the most influential factor in psoriasis prevention and treatment. This result was also found by Yeung et al (27). The more comorbidity people had, the more medicines they were prescribed for parallel treatment, which led to soaring costs and patient depression because of numerous medicines. In addition, other costs also influenced psoriasis treatment costs such as healthcare workers, ambulance, and emergency expenses (28).

Last but not least, the outcomes indicated an enormous growth in expenditures observed in 2021, in which the Inpatient department expenses skyrocketed. To be clearer, the treatment of psoriasis and associated comorbidities was largely responsible for that leap (Table 1). Similarly, an upward trend was witnessed in the quantity of hospitalized psoriatic patients compared to the first two years (Table 2).

Conclusion

Through retrospective examining patients who were diagnosed with psoriasis, and had treatment from 2019 to 2021 in Can Tho dermatology hospital:

The number of psoriasis treatment medications increased gradually from 2019 to 2021, especially topical medicines that were commonly used. Medications for psoriasis-supported treatment were commonly used, and H1 antihistamines were the most prescribed medicines. The expense structure for direct medical expenses was, on average, quite high at US $ 120–145.6/turn. The greater use of topical medicine compared to symmetric ones resulted in a considerable spread of cost between the two types of medication. Due to a number of related factors such as health insurance, patient's residence, duration of courses, the number of comorbidities, etc., there was a gradual increase in the costs for psoriasis treatment from 2019 to 2021 which directly affected patient's treatment outcomes.

Limitations

Our study was conducted with a large number of medical records as well as a long-lasting 3 year period so it was hard to avoid some mistakes in data collection, yet it can be acceptable.

Author's contributions

Conceptualization: P.H.N., T.K.V.D.; methodology: T.M.H.V., T.K.V.D., validation: P.H.N., T.N.P, investigation: P.H.N., T.K.V.D., T.M.H.V., T.N.P., resource: T.K.V.D., T.N.P.; writing-original draft: P.H.N., T.K.V.D., L.T.Q.

Available data

Data supporting this study's discoveries were available from Kieu D.T.V.

Guarantor

Dr. Hung N.P.is the guarantor and would take full responsibility for this paper.

Competing Interests

The authors declare there are no competing interests related to this paper.

Funding

This research did not receive any specific grant from funding agencies in the public, commercial, or not-for-profit sectors.

Acknowledgment

The authors are sincerely grateful to the members of the Department of Pharmaceutical Management of Can Tho University of Medicine and Pharmacy, Faculty of Pharmacy, together with the Can Tho Dermatology Hospital. Without their persistent support, this paper would not be thoroughly possible.

Riassunto

Impiego dei farmaci e spese mediche per il trattamento della psoriasi in un ospedale dermatologico vietnamita nel periodo 2019-2021

Introduzione. La psoriasi è un disturbo cutaneo persistente, cronico, infiammatorio, che presenta frequenti ricadute e comporta un impatto negativo sulla qualità della vita di chi ne soffre.

Metodi. I dati delle cartelle cliniche del reparto ospedaliero e ambulatoriale dell'ospedale dermatologico di Can Tho sono stati utilizzati per generare un rapporto statistico-descrittivo sui farmaci e sul loro costo per la terapia della psoriasi nel periodo 2019-2021.

Risultati. Il numero medio di farmaci prescritti variava di anno in anno, con una media di circa 0,62 ± 85,4% farmaci per prescrizione. I corticosteroidi e il calcipotriolo erano i farmaci più comunemente prescritti per la psoriasi. Gli antistaminici sono stati i farmaci più usati, con oltre 12.000 casi tra i 28.397 individui studiati. Il picco delle spese medie per trattamento si è verificato nel 2021, quando hanno oscillato tra $ US 120 e US $ 160. Al contrario, le spese per gli esami sono state le più costose, con un range compreso tra US $ 93 e US $ 107.

Conclusione. La maggior parte dei trattamenti per la terapia della psoriasi consistevano in agenti topici, le cui quantità sono andate aumentando progressivamente. La percentuale maggiore è stata rappresentata dall'esame diretto.

References

1. Heller MM, Wong JW, Nguyen TV, et al. Quality-of-life instruments: evaluation of the impact of psoriasis on patients. Dermatol Clin. 2012; **30**(2): 281-91. doi: 10.1016/J.DET.2011.11.006.
2. Pearce DJ, Spencer L, Hu J, Balkrishnan R, Fleischer AB, Feldman SR. Class I topical corticosteroid use by psoriasis patients in an academic practice. J Dermatolog Treat. 2004; **15**(4): 235-8. doi: 10.1080/09546630410033745.
3. Boehncke WH, Boehncke S, Schön MP. Managing comorbid disease in patients with psoriasis. BMJ. 2010; **340**(7739): 200. doi: 10.1136/BMJ.B5666.
4. Samarasekera E, Sawyer L, Parnham J, Smith CH. Assessment and management of psoriasis: summary of NICE guidance. BMJ. 2012 Oct; **345**: e6712. doi:10.1136/BMJ.E6712.
5. Feldman SR, Fleischer J, Reboussin DM, et al. The economic impact of psoriasis increases with psoriasis severity. J Am Acad Dermatol. 1997; **37**(4):564-569. doi:10.1016/S0190-9622-(97)70172-5.
6. Lee S, Xie L, Wang Y, Vaidya N, Baser O. Comorbidity and economic burden among moderate-to-severe psoriasis and/or psoriatic arthritis patients in the US Department of Defense population. J Med Econ. 2018; **21**(6): 564-70. doi: 10.1080/13696998.2018.1431921.
7. Takeshita J, Grewal S, Langan SM, et al. Psoriasis and comorbid diseases: Epidemiology. J Am Acad Dermatol. 2017; **76**(3): 377-90. doi: 10.1016/J.JAAD.2016.07.064.
8. Nguyen PH, Dang TVK, Nguyen PT, Vo TMH, Nguyen TTM. 5-year inventory management of drug products using ABC-VEN analysis in the pharmacy store of a specialized public hospital in Vietnam. Pharmacia 2022; **69**(2): 517-25. doi:10.3897/PHARMACIA.69.E84348.
9. Javitz HS, Ward MM, Farber E, Nail L, Vallow SG. The direct cost of care for psoriasis and psoriatic arthritis in the United States. J Am Acad Dermatol. 2002; **46**(6): 850-60. doi: 10.1067/MJD.2002.119669.
10. Akhyani M, Ehsani AH, Robati RM, Robati AM. The lipid profile in psoriasis: a controlled study. J Eur Acad Dermatol Venereol. 2007; **21**(10): 1330-2. doi: 10.1111/J.1468-3083.2007.02260.X.
11. Mashor M, Wong KW, Tey KE, Choon SE. A retrospective study on drug survival of biologic among patients with psoriasis seen in tertiary hospital in Johor Malaysia. Med J Malaysia. 2022 Nov; **77**(6): 689-95.
12. Al Sawah S, Foster SA, Goldblum OM, et al. Healthcare costs in psoriasis and psoriasis sub-groups over time following psoriasis diagnosis. J Med Econ. 2017; **20**(9): 982-90. doi: 10.1080/13696998.2017.1345749.
13. Antoni CE, Kavanaugh A, Kirkham B, et al. Sustained benefits of infliximab therapy for dermatologic and articular manifestations of psoriatic arthritis: Results from the Infliximab Multinational Psoriatic Arthritis Controlled Trial (IMPACT). Arthritis Rheum. 2005; **52**(4): 1227-36. doi: 10.1002/art.20967.
14. Galimberti ML, Vacas AS, Hernández BA, Bollea Garlatti ML, Cura MJ, Galimberti RL. Medical resource consumption of moderate/severe psoriasis in a private health organization of Buenos Aires, Argentina. An Bras Dermatol. 2020; **95**(1): 20-4. doi: 10.1016/J.ABD.2019.04.007.
15. Lee JH, Lee SM, Choi JH, et al. Factors influ-

encing quality of life in patients with psoriasis in Korea. Eur J Dermatol. 2018; **28**(5):678-80. doi: 10.1684/EJD.2018.3341.
16. Benites E, Carrillo E, Heras M. Effects of methotrexate and etanercept treatment in moderate and severe psoriasis. Medicine. 2022; **101**(45): e31527. doi: 10.1097/MD.0000000000031527.
17. Feldman SR, Zhao Y, Shi L, Tran MH. Economic and Comorbidity Burden Among Patients with Moderate-to-Severe Psoriasis. J Manag Care Spec Pharm. 2015; **21**(10): 874-88. doi: 10.18553/JMCP.2015.21.10.874.
18. Feldman SR, Burudpakdee C, Gala S, Nanavaty M, Mallya UG. The economic burden of psoriasis: a systematic literature review. Expert Rev Pharmacoecon Outcomes Res. 2014; **14**(5): 685-705. doi: 10.1586/14737167.2014.933671.
19. Dreiher J, Weitzman D, Shapiro J, Davidovici B, Cohen AD. Psoriasis and chronic obstructive pulmonary disease: a case–control study. British Journal of Dermatology. 2008; **159**(4): 956-60. doi: 10.1111/J.1365-2133.2008.08749.X.
20. Ghasri P, Yentzer BA, Dabade TS, Feldman SR. Acitretin for the treatment of psoriasis: an assessment of national trends. J Drugs Dermatol. 2011 Aug; **10**(8): 873-7. PMID: 21818508.
21. Bhuvana KB. Drug prescribing pattern of topical corticosteroids in dermatology unit of a tertiary-care hospital. Int J Med Sci Public Health Online. Published online 2015. doi: 10.5455/ijmsph.2015.17052015351.
22. Augustin M, Schäfer I, Reich K, Glaeske G, Radtke M. Systemic treatment with corticosteroids in psoriasis--health care provision far beyond the S3-guidelines. J Dtsch Dermatol Ges. 2011; **9**(10): 833-8. doi: 10.1111/J.1610-0387.2011.07713.X.
23. Boffa MJ. Methotrexate for psoriasis: current European practice. A postal survey. J Eur Acad Dermatol Venereol. 2005; **19**(2): 196-202. doi: 10.1111/J.1468-3083.2004.01140.X.
24. Burgos-Pol R, Martínez-Sesmero JM, Ventura-Cerdá JM, Elías I, Caloto MT, Casado M. The Cost of Psoriasis and Psoriatic Arthritis in 5 European Countries: A Systematic Review. Actas Dermosifiliogr. 2016; **107**(7): 577-90. doi: 10.1016/J.AD.2016.04.018.
25. Carrascosa JM, Pujol R, Daudén E, et al. A prospective evaluation of the cost of psoriasis in Spain (EPIDERMA project: phase II). J Eur Acad Dermatol Venereol. 2006; **20**(7) :840-5. doi: 10.1111/J.1468-3083.2006.01659.X.
26. Evans C. Managed care aspects of psoriasis and psoriatic arthritis. Am J Manag Care. 2016 Jun; **22**(8 Suppl): s238-43. PMID: 27356195.
27. Yeung H, Takeshita J, Mehta NN, et al. Psoriasis severity and the prevalence of major medical comorbidity: a population-based study. JAMA Dermatol. 2013; **149**(10): 1173-9. doi: 10.1001/JAMADERMATOL.2013.5015.
28. Lee S, Xie L, Wang Y, Vaidya N, Baser O. Evaluating the Effect of Treatment Persistence on the Economic Burden of Moderate to Severe Psoriasis and/or Psoriatic Arthritis Patients in the U.S. Department of Defense Population. J Manag Care Spec Pharm. 2018; **24**(7): 654-63. doi: 10.18553/JMCP.2018.24.7.654.

Corresponding author: Phuong Thuy Nguyen, Faculty of Pharmacy, Can Tho University of Medicine and Pharmacy, 179 Nguyen Van Cu st, Can Tho 90000, Vietnam
e-mail: 1953030069@student.ctump.edu.vn, phuchung275@gmail.com

ORCID and email:
Hung Nguyen: 0000-0003-3747-2776, nphung@ctump.edu.vn
Huong Vo: 0000-0002-9904-7719, vtmhuong@ctump.edu.vn
Kieu Dang: dtvkieubvdl@gmail.com
Nguyen: 0000-0002-3386-4548, 1953030069@student.ctump.edu.vn

SUPPLEMENTAL MATERIALS

Table S1 - In-patients' and outpatients' records with psoriasis diagnosis in 2019-2021

No. medical records / Year	Inpatient	Outpatient	Total
2019	86	1,428	1,514
2020	83	1,736	1,819
2021	57	1,120	1,177

Table S2 - Quantities and proportions of psoriatic medications used in 2019-2021

Usage characteristics	Year			No. patients (±± SD)
	2019	2020	2021	
Systemic medications				
Methotrexate	29 (0.2%)	36 (0.28%)	12 (0.02%)	25.67±12.98%
Acitretin	229 (1.6%)	197 (1.56%)	127 (0.22%)	184.33±31.1%
Secukinumab	34 (0.24%)	92 (0.73%)	113 (0.19%)	79.67±57.32%
Topical medications				
Corticosteroids	7 (0.05%)	0	4,668 (8.01%)	1,558.33±199%
Calcipotriol	896 (6.28%)	1,103 (8.73%)	1,029 (1.77%)	1,009.33±11.23%
Tacrolimus	3 (0.02%)	3 (0.02%)	17 (0.03%)	7.67±121%
Salicylic acid	1 (0.01%)	105 (0.83%)	5 (0.01%)	37±183%
Medications for comorbid diseases				
Antihistamine H1	6,125 (42.93%)	6,086 (48.15%)	24,208 (41.54%)	12,139.67 ±99.41%
Antibiotics	990 (6.94%)	852 (6.74%)	9,387 (16.11%)	3,743±151%
NSAIDs	51 (0.36%)	44 (0.35%)	37 (0.06%)	44±15.91%
Medications for hypertesion	288 (2.02%)	154 (1.22%)	1,027 (1.76%)	489.67±109.73%
Anti-ulcers	187 (1.31%)	124 (0.98%)	4,079 (7%)	1,463.33±179%
Others				
Multi-vitamins and minerals	5,283 (37.02%)	3,700 (29.27%)	1,2167 (20.88%)	7,050±72.58%
Liver detox drugs	138 (0.97%)	120 (0.95%)	1,406 (2.41%)	554.67±153%
Iron + folic acid	8 (0.06%)	24 (0.19%)	0	10.67±125%
Total	14,269 (100%)	12,640 (100%)	58,282 (100%)	28,397±105%

Table S3 - Total spending on psoriatic topical and systemic medications at CTDH

Categories	Year			Cost range/case/year
	2019	2020	2021	
Systemic medications				
Metrotrexate	11.3	17.1	3.8	0.3 – 0.5
Acitretin	620.7	691.9	265.9	2.6 – 3.1
Ciclosporin	0	0	0	0
Secukinumab	19,596.5	62,168.1	76,358.6	675.7
Topical medications				
Corticosteroids	1.0	0	317.5	0.1
Calcipotriol	5,694.8	6,433.7	5,835.6	5.9 – 6.0
Tacrolimus	19.4	19.4	142.6	6.7 – 9.1
Salicylic acid	0.3	89.2	1.9	0.8 – 0.9